

Renal Trauma

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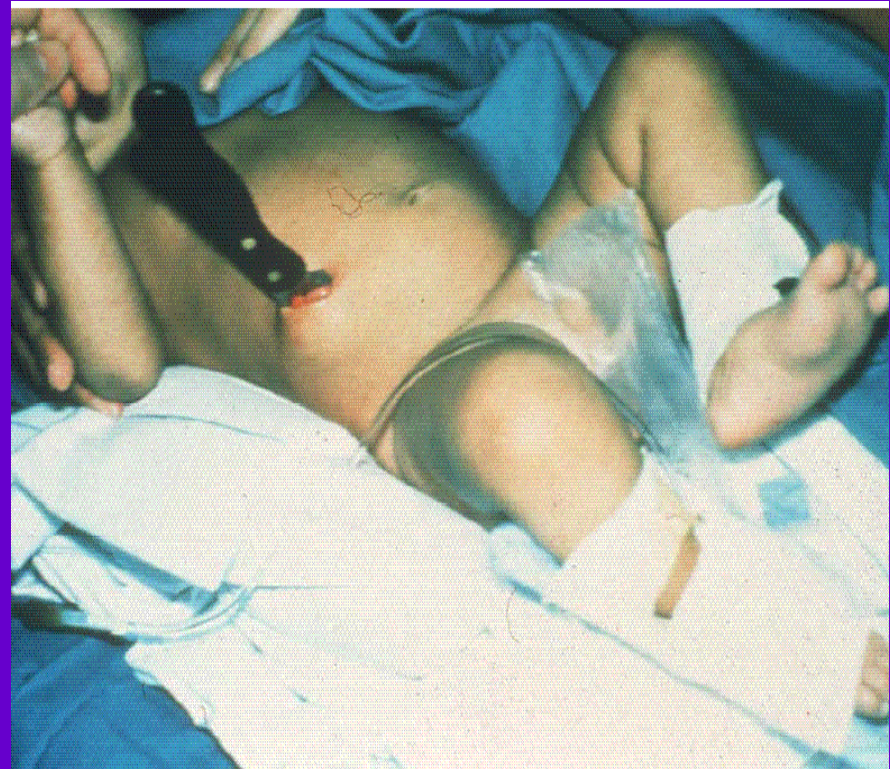
- blunt injuries 80-90%
- penetrating injuries 10-20%

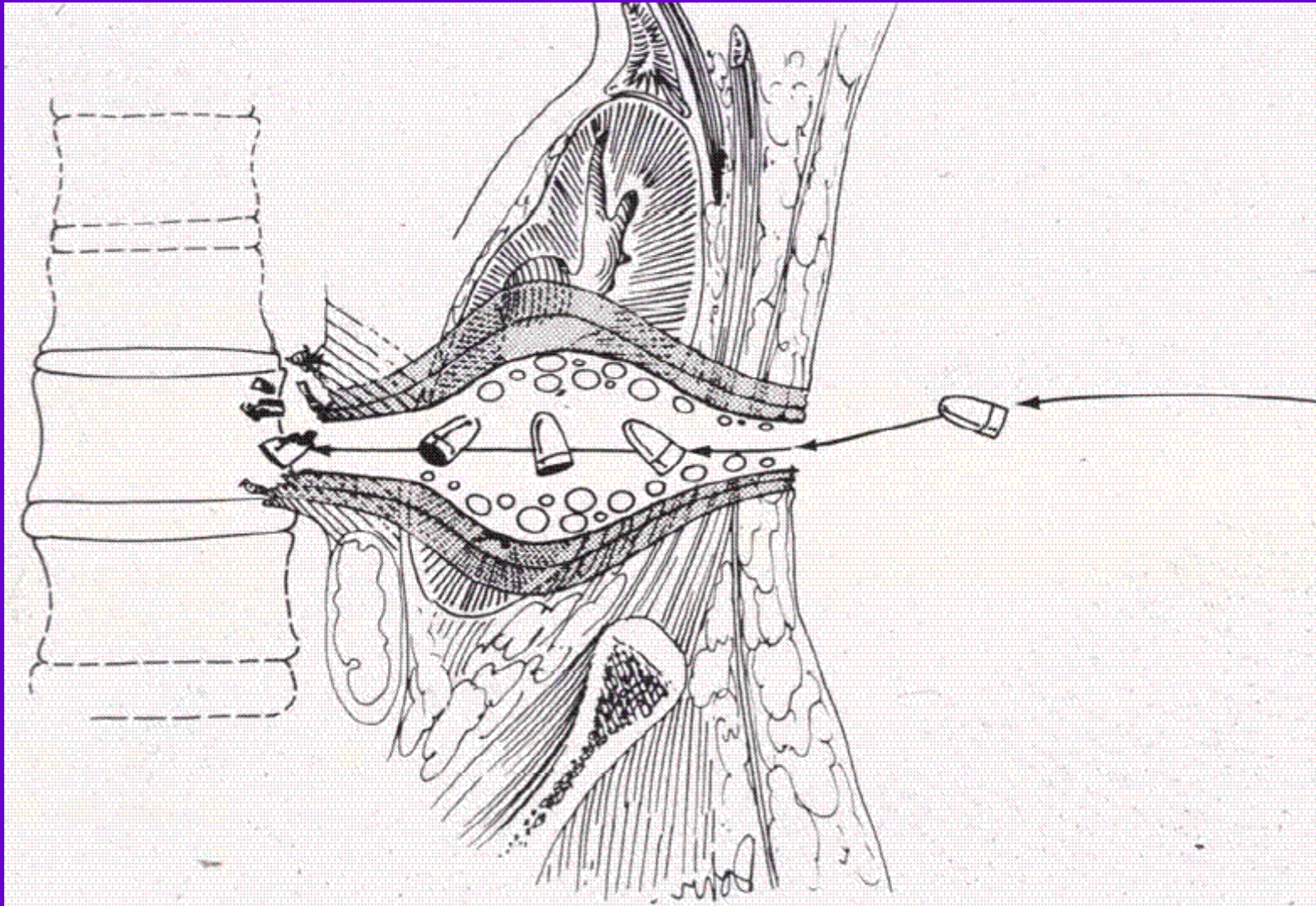
Incidence and Etiology

- **Injuries to the kidney from external trauma are the most common.**
- **Blunt renal injuries are most often caused by motor vehicle accidents, falls from heights, and assaults.**
- **Rapid deceleration can cause vascular damage to the renal vessels, resulting in renal artery thrombosis, renal vein disruption, or renal pedicle avulsion.**

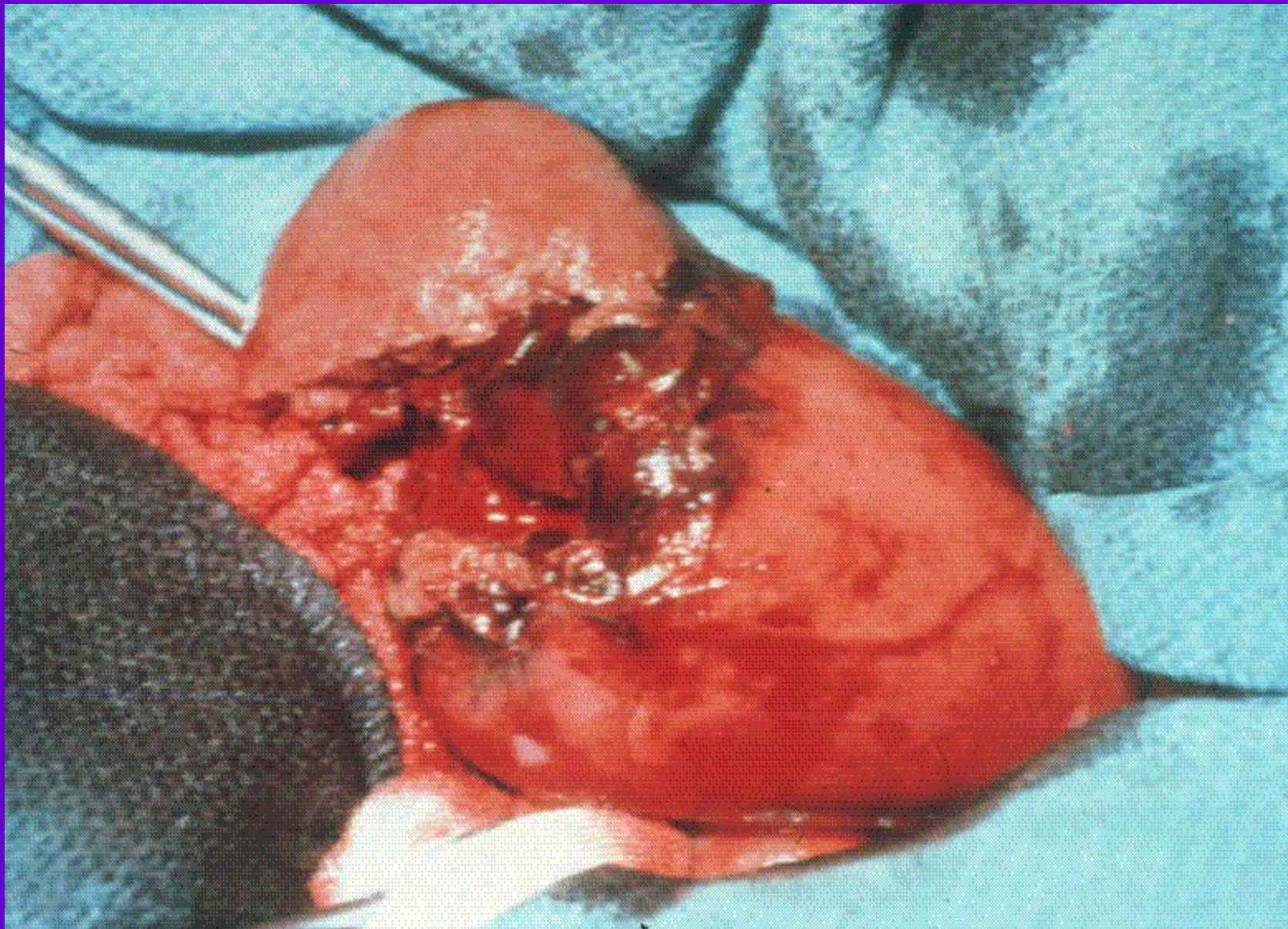
Etiology and clinical picture

- Penetrating renal injuries most often come from:
 - Stab wounds.





And gunshot

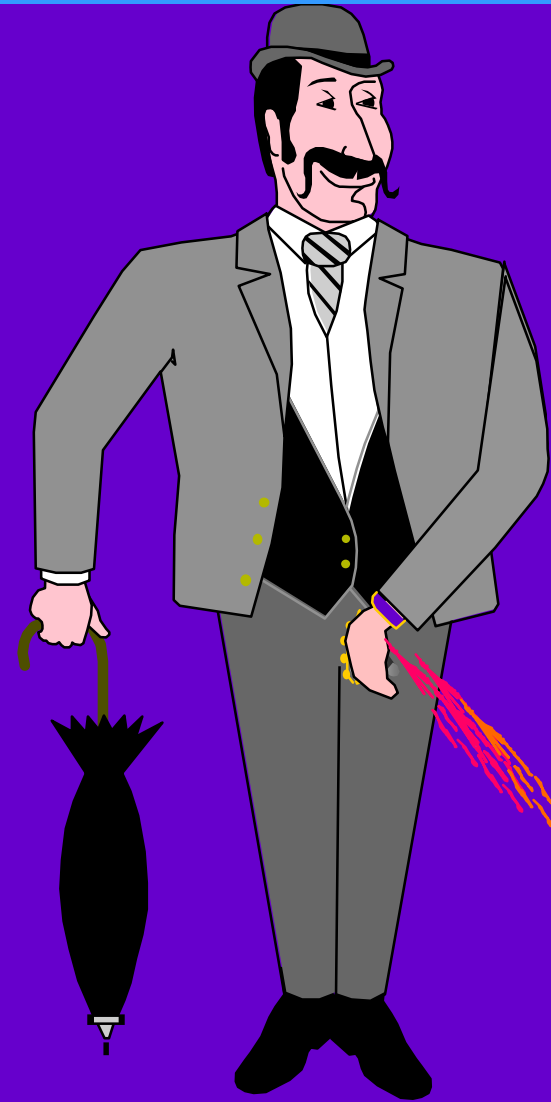




- **The abdomen, chest, and back must be examined: fractures of the lower ribs and upper lumbar and lower thoracic vertebrae are associated with renal injuries.**

Hematuria

Is the best
indicator of
urinary system
injury.



Hematuria

- gross
- microscopic
- >5 RBC

Hematuria

- The degree of hematuria does not correlate with severity of renal injury.
- Hematuria is absent in up to 36% of renal vascular injuries resulting from blunt trauma, (Cass, 1989).

Hematuria

Timing: first void or aliquot

Method: dipstick
microanalysis

Hematuria

- We use the first aliquot of urine obtained either by catheterization or by voiding to determine the presence of hematuria.
- Later urine samples are often diluted by diuresis from resuscitation fluids, resulting in an underestimation or absence of hematuria

Hematuria

- **Visible blood of any degree in the urine is regarded as gross hematuria.**
- **Microscopic hematuria can be detected by dipstick analysis or microanalysis.**
- **The dipstick method is rapid and has a sensitivity and specificity for detection of microhematuria of more than 97%.**

Methods of Radiographic Assessment

- IVP
- CT
- angiography

Imaging

- Indications for imaging:
 - All blunt trauma with gross or microscopic hematuria and shock (systolic blood pressure of less than 90 mm Hg any time during evaluation and resuscitation) should undergo renal imaging, usually CT with intravenous contrast.
 - Penetrating injuries with any degree of hematuria should be imaged.

Imaging

- Indications for imaging:
 - Pediatric patients (younger than 16 years) sustaining blunt renal trauma must be carefully evaluated for hematuria.
 - Brown and colleagues (1998a) noted that children are at greater risk of renal trauma than adults after blunt abdominal injury.

Imaging

- Indications for imaging:
 - Children have a high catecholamine output after trauma, which maintains blood pressure until approximately 50% of blood volume has been lost.
 - Shock is not a useful parameter in children to determine if imaging studies should be performed or not.

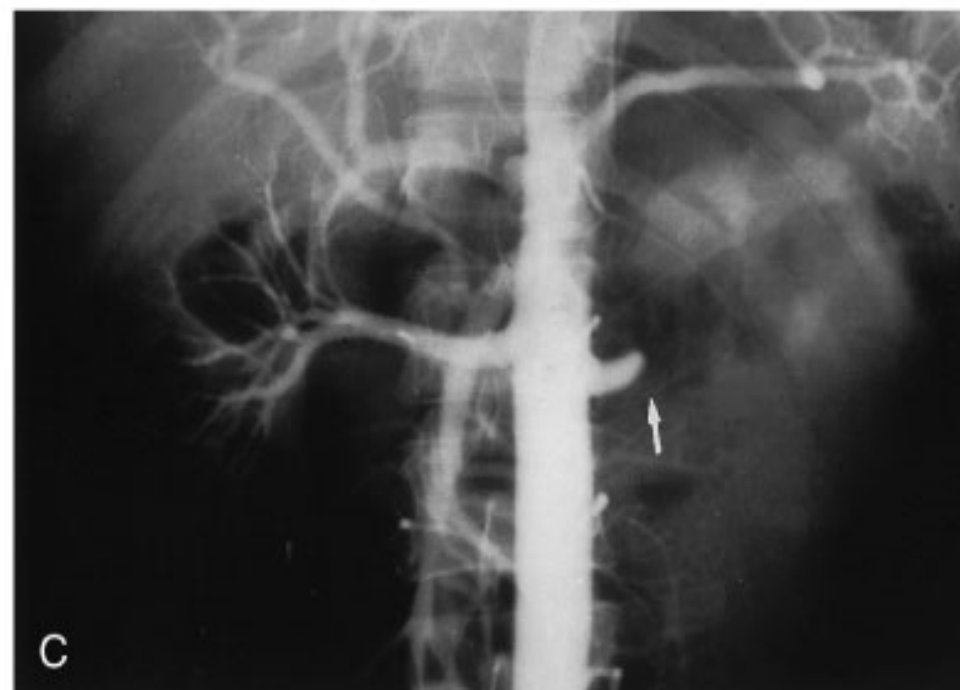
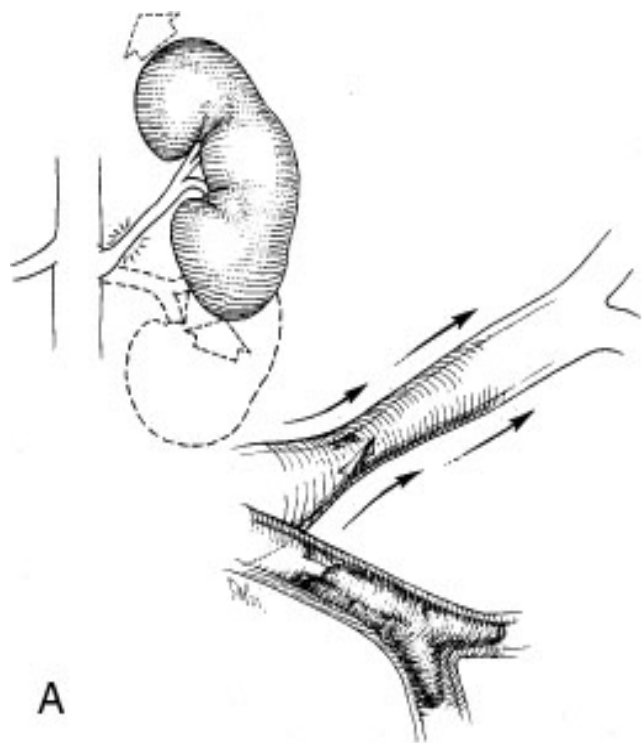
Imaging CT

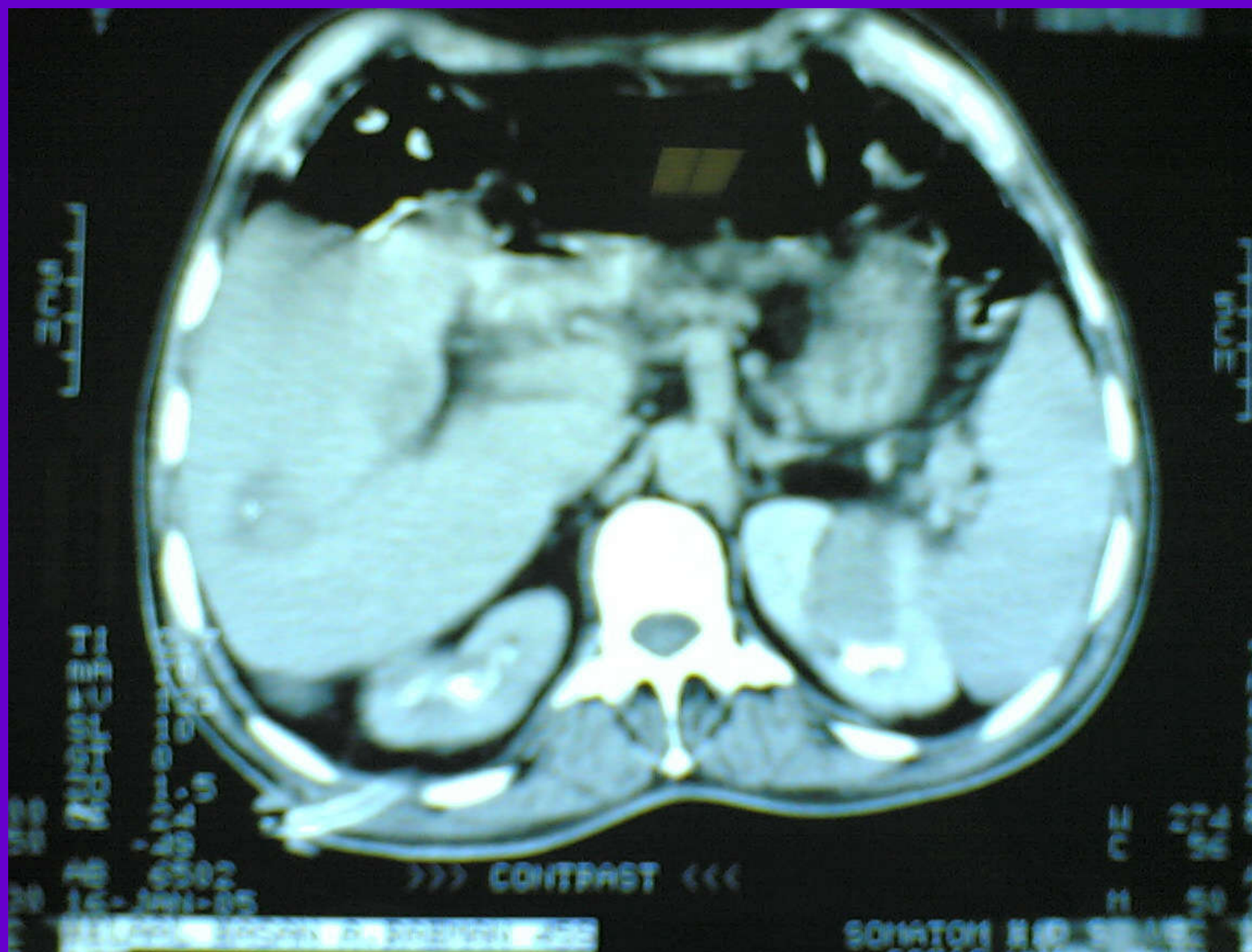
- Use of contrast-enhanced computed tomography (CT) has provided anatomic detail and facilitates accurate grading of renal injuries (Bretan et al, 1986).
- In contrast, excretory urography is less sensitive and much less specific.

Imaging CT

- **The preferred imaging study for renal trauma is contrast-enhanced CT.**
- **Spiral CT is used in many centers to evaluate renal injuries. Although the rapidity of the study 2 to 3 minutes is a major disadvantage in renal injuries.**







Imaging CT

- Contrast excreted into the parenchyma and collecting system, and parenchymal lacerations in no time thus → urinary extravasation cannot be detected reliably.
- Repeat scanning of the kidneys after 10 minutes after injection will demonstrate parenchymal and most collecting system injuries.

Imaging CT

- Findings on CT that suggest major injury are:
 - (1) medial hematoma, suggesting vascular injury.
 - (2) medial extravasation, suggesting renal pelvis or ureteropelvic junction avulsion.
 - (3) lack of contrast enhancement of the parenchyma, suggesting arterial injury.

Imaging IVU

- "single-shot" intraoperative excretory urography.
- When the surgeon encounters an unexpected retroperitoneal hematoma surrounding a kidney during abdominal exploration, the study can provide essential information.
- *Only a single film* is taken 10 minutes after intravenous injection of 2 mL/kg of contrast material.
- If findings are not normal or near normal, the kidney should be explored to complete the staging of the injury and reconstruct any abnormality found.

Imaging - angiography

- **Arteriography is largely used to define arterial injuries suspected on CT or to localize arterial bleeding that can be controlled by embolization**

Imaging - sonography

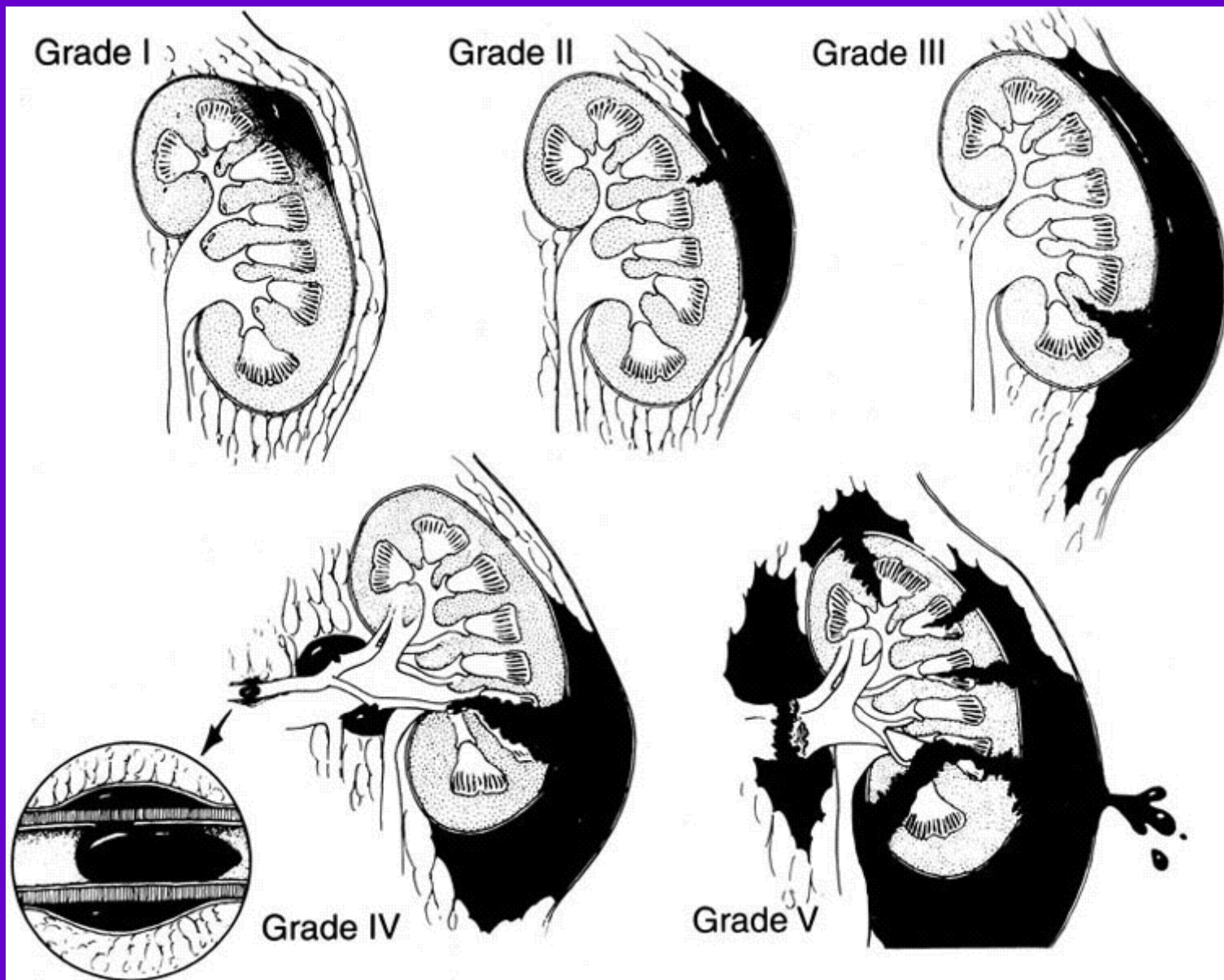
- **Sonography: used in immediate evaluation of injuries.**
- **It confirms the presence of two kidneys and can easily define any retroperitoneal hematoma.**
- **The study cannot clearly delineate parenchymal lacerations and vascular or collecting system injuries and cannot accurately detect urinary extravasation in acute injuries.**
- **Doppler provides more functional information during acute injury phase.**

Table 105–1. AMERICAN ASSOCIATION FOR THE SURGERY OF TRAUMA ORGAN INJURY SEVERITY SCALE FOR THE KIDNEY

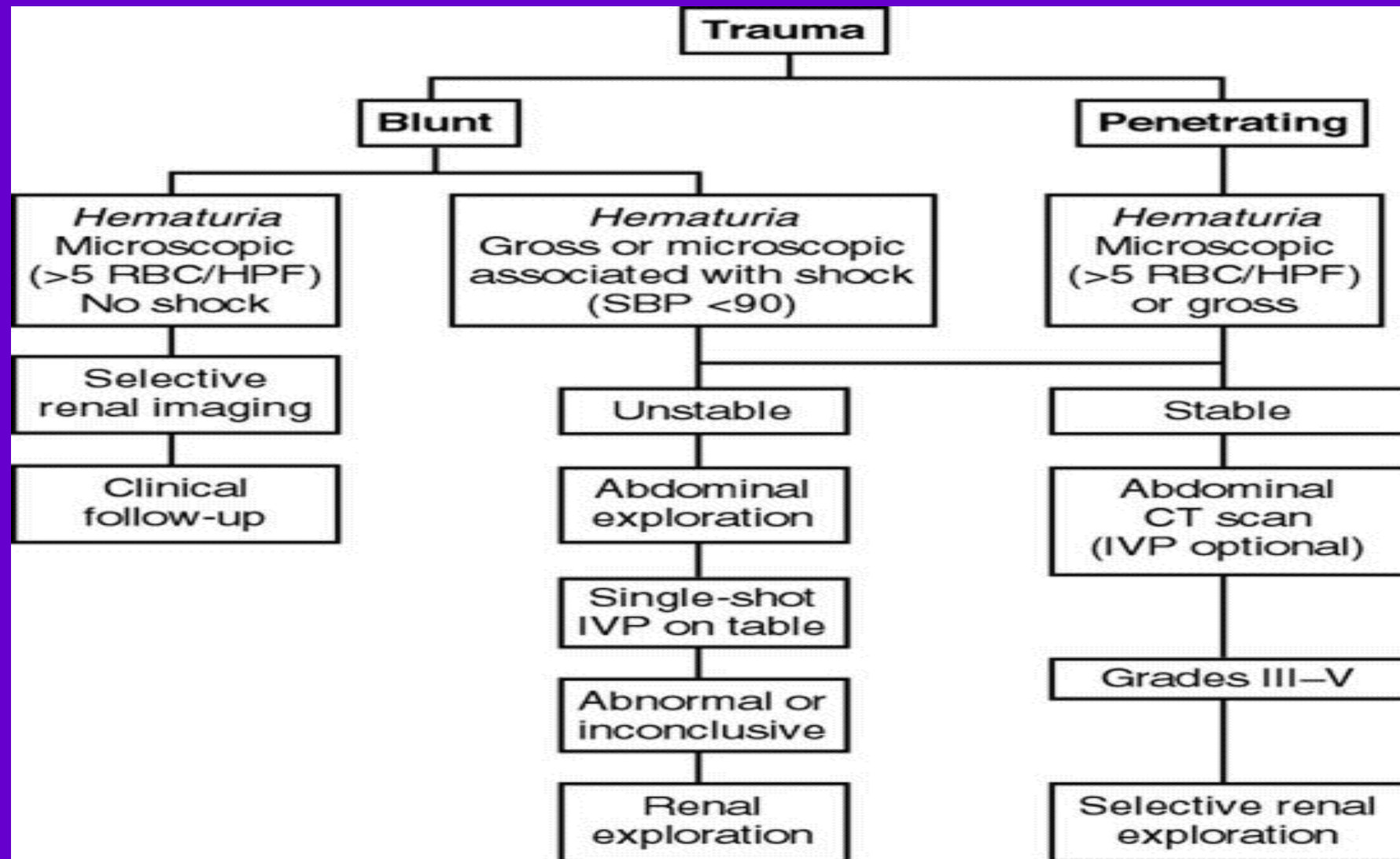
Grade*	Type	Description
I	Contusion	Microscopic or gross hematuria, urologic studies normal
	Hematoma	Subcapsular, nonexpanding without parenchymal laceration
II	Hematoma	Nonexpanding perirenal hematoma confined to renal retroperitoneum
	Laceration	<1-cm parenchymal depth of renal cortex without urinary extravasation
III	Laceration	>1-cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation
IV	Laceration	Parenchymal laceration extending through renal cortex, medulla, and collecting system
	Vascular	Main renal artery or vein injury with contained hemorrhage
V	Laceration	Completely shattered kidney
	Vascular	Avulsion of renal hilum, devascularizing the kidney

*Advance one grade for bilateral injuries up to grade III.

Data from Moore EE, Shackford SR, Pachter HL, et al. Organ injury scaling: Spleen, liver, and kidney. J Trauma 1989;29:1664–1666.



Management of renal trauma



Management of renal trauma

- Non-operative Management:
 - 98% of renal injuries can be managed nonoperatively.
 - Significant injuries (grades II through V) are found in only 5.4% of renal trauma cases (Miller and McAninch, 1995).

Management of renal trauma

- Surgical exploration:
 - Grade IV and V injuries more often require surgical exploration. (Santucci and McAninch, 2000)
 - Penetrating trauma usually need exploration but can be managed non-operatively if carefully staged with CT.

Management of renal trauma

- Indications for renal exploration

- Absolute indications:

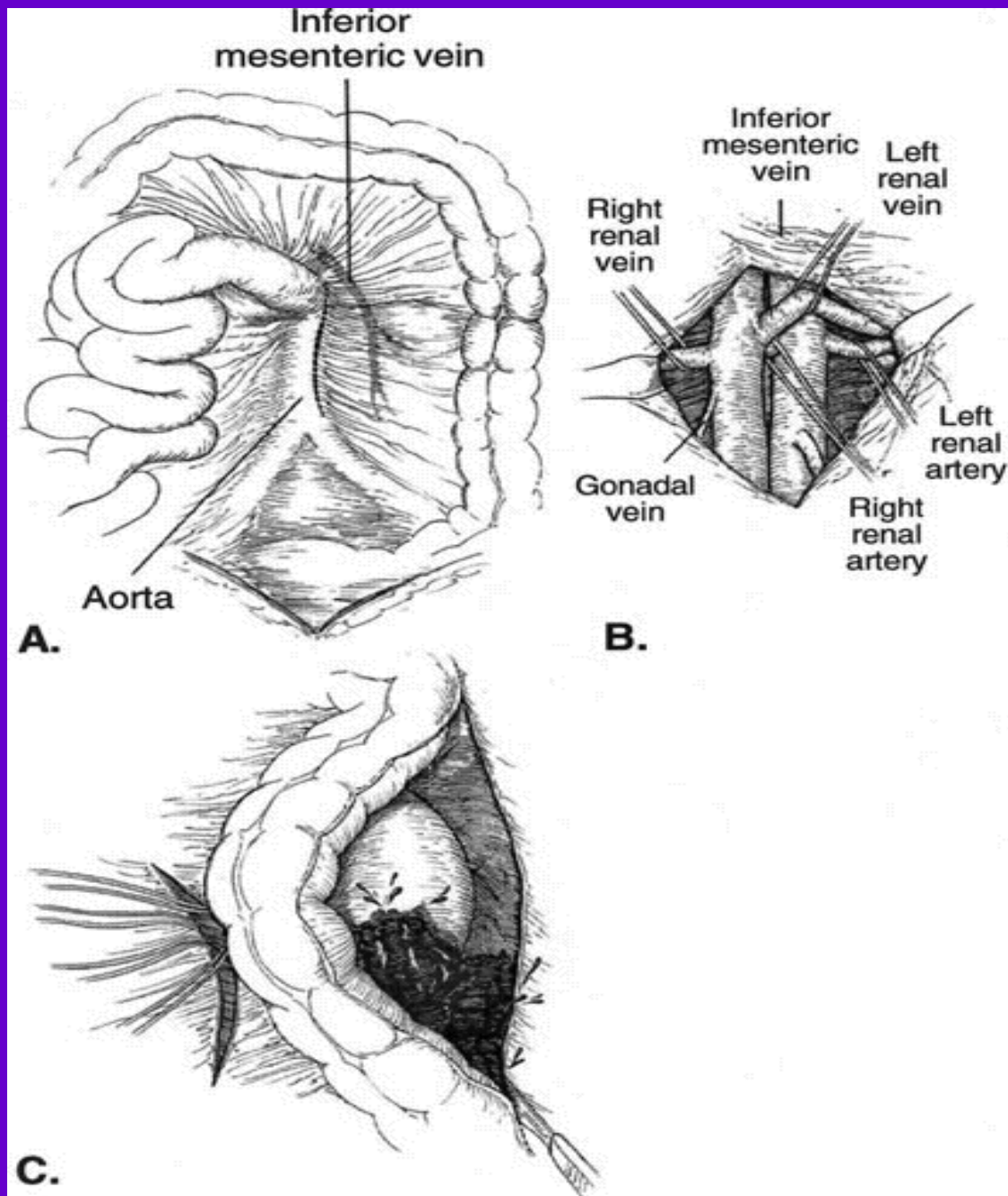
- Evidence of persistent renal bleeding,
 - Expanding perirenal hematoma,
 - Pulsatile perirenal hematoma.

- Relative:

- Urinary extravasation,
 - Nonviable tissue,
 - Delayed diagnosis of arterial injury, segmental arterial injury, and incomplete staging. ([McAninch](#) et al, 1991).

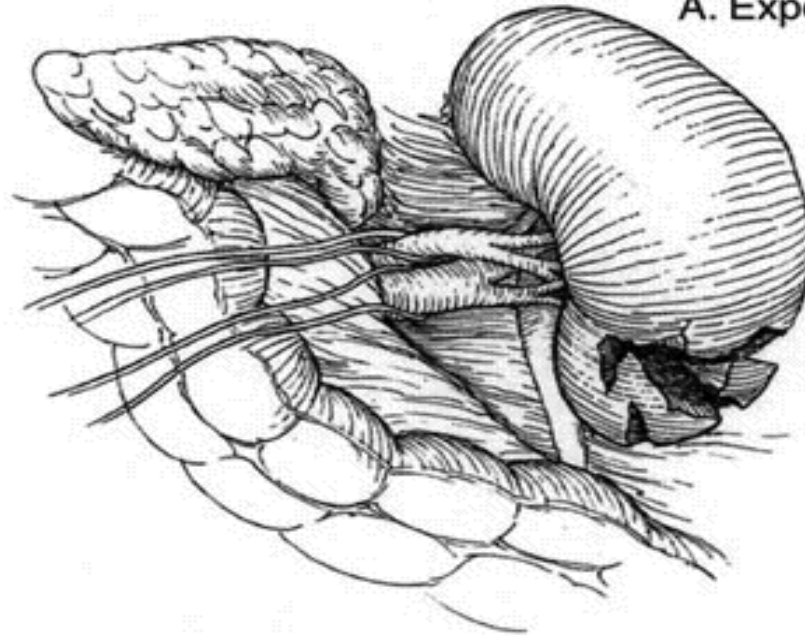
Management of renal trauma

- **Via a transabdominal approach allows complete inspection of intra-abdominal organs and bowel.**
- **Complete renal exposure, débridement, hemostasis, watertight closure of the collecting system, and coverage or approximation of the parenchymal defect**

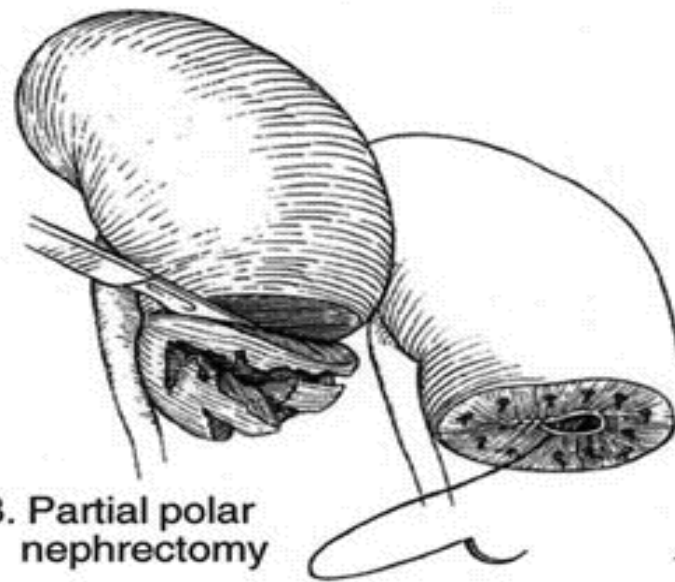


LOWER POLE LACERATION

A. Exposed kidney



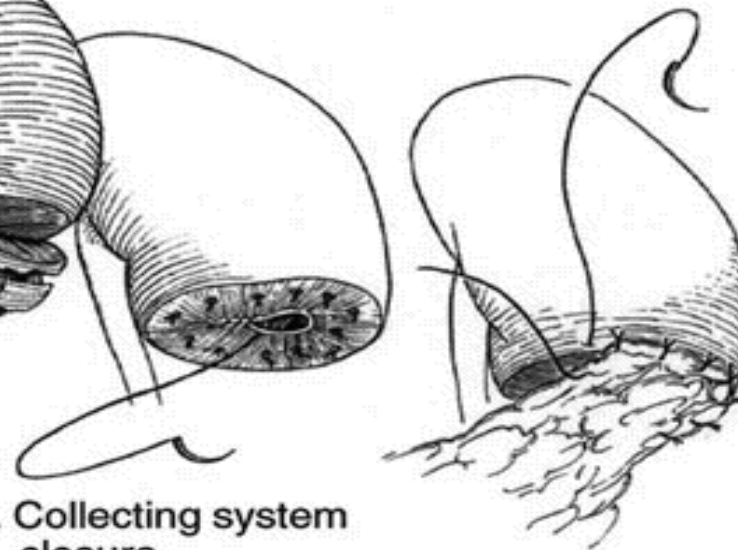
B. Partial polar nephrectomy

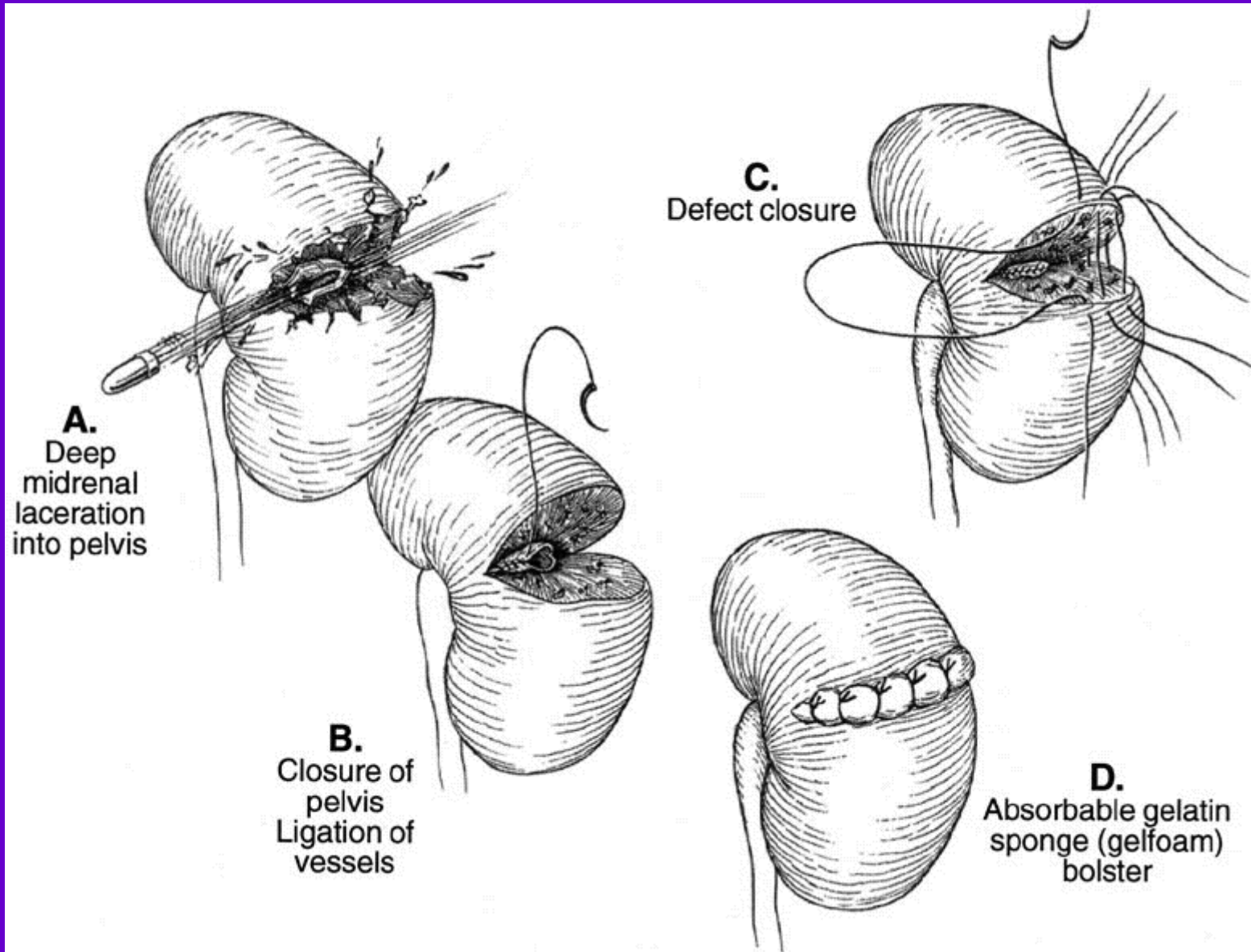


C. Collecting system closure



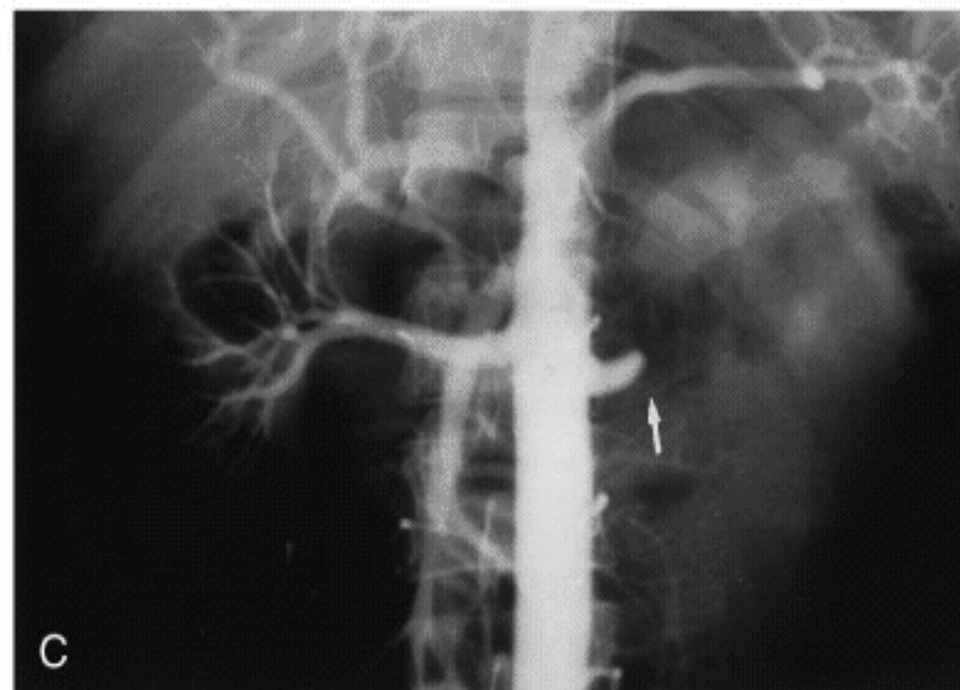
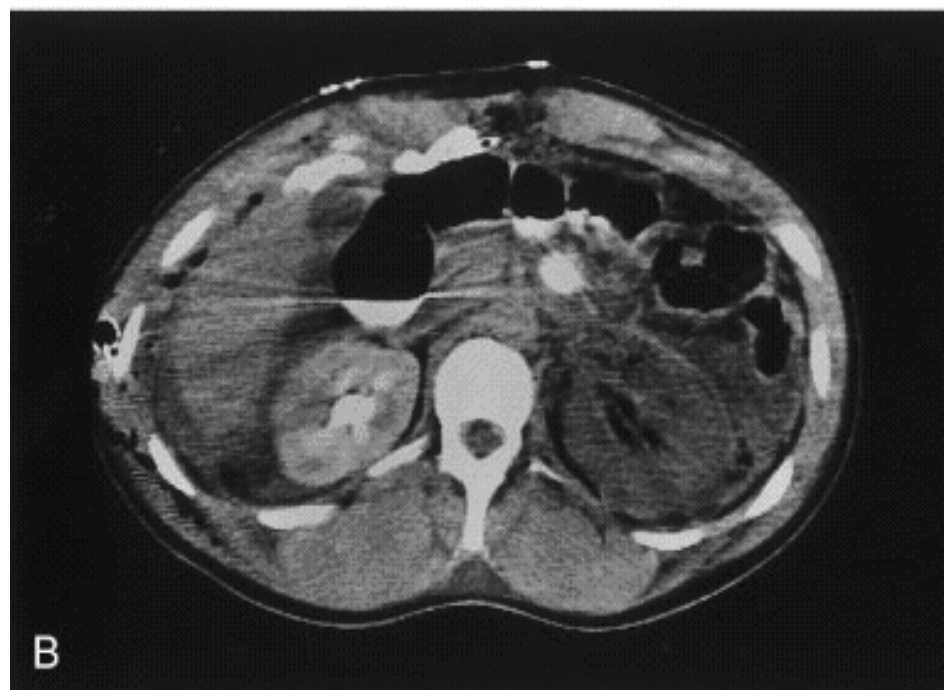
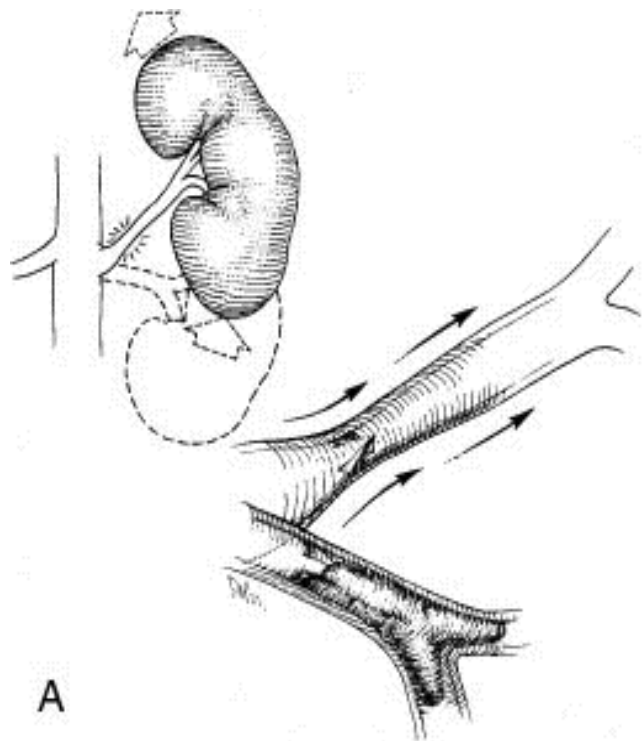
D. Omental pedicle flap



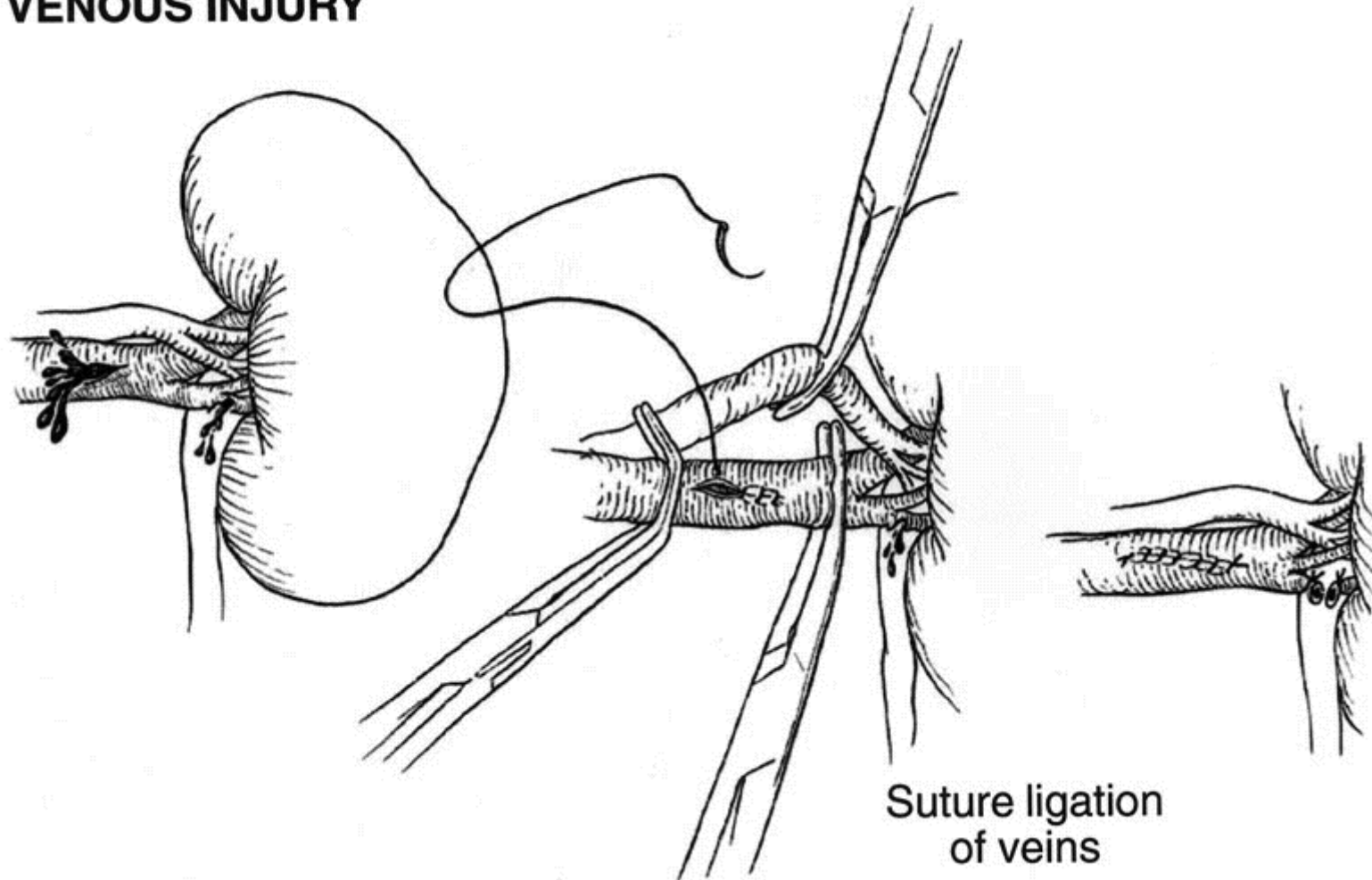


Management of renal trauma

- **Main renal artery thrombosis from blunt trauma occurs secondary to deceleration injuries**
- **The mobility of the kidney results in stretch on the renal artery; this, in turn, causes the arterial intima, low in elastic fibers, to disrupt; the consequent thrombus occludes the vessel, rendering the kidney ischemic**



VENOUS INJURY



Management of renal trauma

- **Total nephrectomy is immediately indicated in extensive renal injuries when the patient's life would be threatened by attempted renal repair.**

Complications

- Persistent urinary extravasation can result in urinoma, perinephric infection, and renal loss.
- Delayed renal bleeding can occur several weeks after injury, but it usually occurs within 21 days. Initial management is bed rest and hydration. Should the bleeding persist, angiography can often localize the bleeding vessel, and embolization can often gain control

Complications

- *Perinephric abscess* rarely occurs after renal injury
- *Hypertension* is seldom noted in the early postinjury period
- *Post-trauma arteriovenous fistula.*

Indications for Nephrectomy

- Total nephrectomy is immediately indicated in extensive renal injuries when the patient's life would be threatened by attempted renal repair.
- Nash and associates (1995):
 - 77% the extent of parenchymal, vascular, or combined injury,
 - 23% nephrectomy in reconstructable kidneys because of hemodynamic instability.